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Report of Special Committee
San Francisco Chapter
American Association of Engineers
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Disposal of Electrical Energy
From
Hetch Hetchy Project

San Francisco, California
1924

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SAN FRANCISCO CHAPTER

AMERICAN ASSOCIATION OF ENGINEERS

REPORT OF SPECIAL COMMITTEE ON HETCH HETCHY POWER

December 11, 1923.

This Committee was appointed in accordance with the resolution of the Chapter at its meeting of July 10, 1923, to investigate and report upon the disposal of electrical energy from the Hetch Hetchy Project. It has made a careful study of all information available, including Congressional Acts, California statutes and court decisions, official reports and bulletins, transactions of civic organizations, etc., and submits its report as follows:

Under date of July 23, 1923, the Committee addressed a communication to the Board of Supervisors of the City and County of San Francisco drawing attention to the lack of reliable information regarding the Hetch Hetchy power situation and urging that the recommendation of City Engineer M. M. O'Shaughnessy in his report of April 4, 1923, to the Public Utilities Committee be acted upon. The Board on July 30 authorized the City Engineer to make a report on the disposal of the Moccasin Creek Power output and the Committee was greatly assisted in its work by this report, which was submitted to the Board under date of September 11, 1923. The Committee asked further that the opinion of the City Attorney be obtained as to the legality of a plan similar to that adopted by the City of Los Angeles. By this plan, the City, under its charter restrictions regarding sale to private companies, was enabled for a number of years to wholesale a portion of its municipally generated electrical energy through the distribution system of the Southern California Edison Company. No answer has been received from the Board on this point and as far as the Committee is aware the City Attorney has not been called upon for an opinion on the matter.

SUMMARY OF FACTS

The Committee's investigation soon led to the conclusion that the power project could not be considered without taking into account the water supply project. In fact, when a proper perspective is attained, it appears that electrical energy is but a by-product of the Hetch Hetchy water project. The future of San Francisco, and in fact the whole Bay Region, depends primarily upon the securing of an ample and dependable supply of water from distant sources. The magnitude of such an undertaking is too great for private effort, involving as it does a long period of development and progressive use during which an enormous investment is tied up without productive income. In this respect large water enterprises are unique. Economy in construction requires that storage and permanent transmission structures be built to ultimate size, and in the West the relative scarcity of water makes it necessary to secure basic rights many years in advance of actual need of the water. With these considerations in mind the Hetch Hetchy Project was conceived more than twenty years ago as a municipal Water project. Time is fast showing that the Hetch Hetchy is only one of the distant supplies that must be brought to the San Francisco Bay Region within this generation if the possible growth in population and industry is to materialize. With this point of view, the Committee gathered information for both water and power features in order to intelligently report upon the power.

Water Requirements of San Francisco

The present demand for water, based on the amount delivered by the Spring Valley Water Company in 1922, is at the average rate of 36.4 million gallons per day. Largely as a result of the installation of meters, the demanc has shrunk during the past few years, the maximum rate attained havin been 42.6 million gallons per day in 1915. The demand has apparentl reached its new equilibrium and will increase in the future as the populatio grows and new uses are established.

In planning water supply for large cities and metropolitan areas it has become the practice of water works engineers to look forward 25 to 50 years in acquiring new sources of supply. Various estimates made by engineers for San Francisco's water requirements 50 years hence, range from 100 to 150 million gallons per day, depending upon the population and rate of consumption assumed. These estimates are for the City with its present political boundaries.

The Raker Act, under Section 9, paragraph H, requires that the city "shall not divert beyond the limits of the San Joaquin Valley any more of the waters from the Tuolumne watershed than, together with the waters which it now has or hereafter acquires, shall be necessary for its beneficial use for domestic and other municipal purposes."

This clause has been generally interpreted to mean that the City must make full use of local sources of supply, including the acquisition of the Spring Valley Water Company, before using water from Hetch Hetchy. The ultimate yield of the Spring Valley sources has been variously estimated at from 105 to 252 million gallons per day. The present Chief Engineer of the Company estimates the available supply at from 167 to 187 million gallons per day, but there is difference of opinion as to the sufficiency of certain of the sources and the cost of development. It is clear, however, that the undeveloped local supplies will meet the increased needs of San Francisco for many years to come even at the most conservative estimate, and that if the clause in the Raker Act has been correctly interpreted, the use of Hetch Hetchy by San Francisco will be deferred many years unless the present boundaries of the City are enlarged or the water shared with other communities.

The yield of the Hetch Hetchy storage project as now partially built, with full allowance for the restrictions of the Raker Act and existing water rights, has been estimated by Mr. John D. Galloway as 200 million gallons per day. The present storage capacity in O'Shaughnessy Reservoir and Lake Eleanor is 231,000 acre feet. With the completion of these dams to ultimate height and construction of six additional dams on the upper Tuolumne with a grand total storage capacity of 836,800 acre feet, Mr. Galloway has estimated the ultimate yield of the Hetch Hetchy Project as 400 million gallons per day. It has not been fully demonstrated that the watersheds above these reservoirs are all sufficiently productive to fill them or that water can be brought from adjacent areas at reasonable cost. Mr. Harroun has estimated the yield at 290 million gallons daily with storage totaling 561,000 acre feet. All estimates show that the yield of Hetch Hetchy alone, without local sources at present undeveloped, is far in excess of the future needs of San Francisco with its present boundaries. It is thus obvious that Hetch Hetchy water is permanently available for use in areas outside of San Francisco.

Water Requirements of the Metropolitan Area

The Committee in considering the water requirements of the future San Francisco metropolitan area, has included a larger area than has been done in engineering reports in the past. A new element is now entering into the growth of the metropolitan area, namely, the construction of transbay bridges. One has already been commenced at Carquinez Straits, another is assured at Dumbarton Point and others have been proposed at Little Coyote Point, across the Golden Gate and from Point San Pablo to Point San Pedro. The effect of bridges in stimulating the growth of the various scattered communities about the Bay and drawing them together is not as yet generally realized. In the view of the Committee, the future metropolitan area will include, not alone San Francisco, the Peninsula and the East Bay Cities, but the entire shores of San Francisco, San Pablo and Suisun Bays and portions of Petaluma, Sonoma, Napa, Suisun, Ignacio and Santa Clara Valleys.

A detailed study of the Bay Region as effected by bridge construction or closer ferry connection has been made by the Committee to determine the probable extent of the future metropolitan area. The government topographic maps were used for this purpose, the boundaries of districts adapted to intensive development for residential, industrial or agricultural purposes being actually laid out and their future relation to centers of population studied with particular reference to transportation. The future metropolitan area as thus outlined was found to have a maximum radius of 40 miles from the present center of population and to contain at least 800,000 acres of usable land. This may be compared with the present area of 286,500 acres and maximum radius of 20 miles for the San Francisco-Oakland Metropolitan District as established by the 1920 U. S. Census.

The present consumption of domestic water in this area, outside of San Francisco, is approximately 50 million gallons per day. Most of the area is inadequately served, growth being held back in many communities by lack of water, and in the case of East Bay Cities an actual shortage is faced. Many communities depend upon wells which are located in areas where excessive pumping has so depleted the underground supply that it is a matter of but a few years before other sources must be sought. A potential demand already exists for more water than is now supplied and the demand is increasing rapidly. A conservative estimate by the Committee of the population 50 years hence in the metropolitan area places it at over 5,000,000, with a demand for additional water, including industrial and agricultural as well as domestic and municipal uses, of nearly 900 million gallons per day. The local supplies are capable of yielding possibly 50 million gallons additional. Water from outside sources will thus be required in excess of 800 million gallons per day. This amount exceeds considerably the combined yield of the Hetch Hetchy and Eel River Projects, the latter having been estimated by Harroun at 250 million gallons per day. In other words, not alone will Hetch Hetchy water be needed in the metropolitan area 50 years hence, but also the Eel River supply and almost as much again from a third outside source, such as the Sacramento River.

It is the Committee's conclusion that, regardless of the fact that Hetch Hetchy water will not be used within the present boundaries of San Francisco for many years, in the interests of the San Francisco Bay metropolitan area as a whole, every effort should be made to preserve the basic water rights upon which this water project depends. San Francisco as an essential integral part of the economic and social life of the future metropolitan community has a responsibility both in self interest and in community welfare to preserve these rights which are necessary to community growth.

Power Requirements of San Francisco

The power consumption for all purposes in San Francisco during 1922, according to data in the City Engineer's report to the Board of Supervisors of September 13, 1923, was 409.5 million kilowatt hours measured at consumers' meters. The rate of increase during the past ten years has been 8 per cent per year. Using a more conservative rate of 5 per cent per annum the estimated demand at consumers' meters in 1928 will be 549 million kilowatt hours.

The estimated output of the present Moccasin Creek power plant with 70,000 installed kilowatts capacity at 50 per cent load factor is 214 million kilowatt hours delivered to consumers. The estimated output of Moccasin Creek Plant with a 105,000 kilowatt installation, increased by 42,000 kilowatts at Early Intake, and 26,000 kilowatts at North Mountain, is 530 million kilowatt hours delivered to consumers. This energy will be largely available prior to the completion of O'Shaughnessy Dam and the construction of auxiliary reservoirs, by diverting, through the City's power tunnels and plants, the water used lower down by the irrigation districts. Ultimately it will be developed entirely from storage water to be conveyed to the Bay Region.

The above figures indicate that the full Hetch Hetchy power development must be completed by 1928 to meet the demands in San Francisco, and that other sources of power must then be drawn upon.

Power Requirements of the Metropolitan Area

The Committee has not compiled detailed statistics of the power requirements of the metropolitan area. It may be stated, however, that the public utilities at present serving this area, including San Francisco, are now supplying every demand and have development programs assuring an ample supply of power for many years to come. The high tension substations and distribution network are laid out and future plans are made, not with reference to individual city loads, but with regard to the needs of the metropolitan area as a whole and with a recognition of its future growth.

Legal Status of Hetch Hetchy Project

The City of San Francisco has legal control of the Hetch Hetchy Project by virtue of certain land and water rights. Land rights were derived either by purchase and ownership, in the case of private land, or through a Congressional grant where public lands were involved. Its ownership of water rights, even on public land, is by authority of the State and not the United States and depends upon the fulfillment of certain requirements laid down in the Civil Code of California and the decisions of State courts. The Federal Government has never questioned this authority and in fact has recognized it both in Acts of Congress and by submitting to State regulations when acquiring water rights for government projects.

The reservoir sites in the Tuolumne River watershed and rights-of-way across public land were granted the City by Congress under the terms of the Raker Act. In addition to certain routine requirements ordinarily included in departmental permits and licenses, the grant contains special limitations with regard, not alone to the use of the land, but the disposal of water and power and even the diversion and use of water. Some of the latter are merely duplications of State requirements, but others prohibit the City from doing what it would have the right to do under State laws.

Several of the clauses relative to the disposal of water and power impair the City's ability to market power. One of these clauses (Section 6), although variously interpreted, is held by many to compel the City to distribute and sell power to consumers over its own municipally owned and operated system. If this interpretation is correct, and the City's financial ability limited so that it is unable to acquire and maintain a power distribution system for the disposal of power from Moccasin Creek Power Plant concurrently with the completion of its water project, a direct conflict with State law would arise, which might result in complete loss of Hetch Hetchy water rights for domestic and municipal purposes.

The City's water rights were initiated at various times, beginning in 1904 by the posting of notices of appropriation. The intended use was declared to be both for power and for domestic and municipal uses. In order to perfect these rights under the State laws, work must be prosecuted with diligence to actual completion and the water conducted to the place of use. Failure to use diligence will deprive the City of its original priority. There are court decisions which hold that lack of funds do not excuse delay. With the prompt completion of the Moccasin Creek Power Plant and use of the water for generation of electrical energy, the City's water rights will have been perfected for power purposes only. Diligence will still be necessary in completion of the water project and in actually carrying the water to the Bay Region in order to perfect the rights for domestic and municipal purposes. Even the right to subsequently use storage water, allowed to waste back into the Tuolumne River from the Moccasin Creek power house for a term of years, might be lost, through the acts of lower appropriators of this water whose rights have in the meantime been perfected by use.

DISPOSAL OF ELECTRICAL ENERGY FROM MOCCASIN CREEK POWER PLANT

It is estimated that the Moccasin Creek Power Plant of the Hetch Hetchy development will be ready in the latter part of 1924 to deliver 70,000 kilowatts of electrical energy into a receiving or distribution system. The load factor at which this energy can be delivered will, of course, depend upon the characteristics of the receiving or distributing system selected.

There are two general methods of disposal possible:

First, by means of a municipal distribution system built or acquired by San Francisco.

Second, by delivery at one point to a public utility and disposal either by wholesale or with the utility acting as the temporary distributing agent of the City.

Municipal Distribution System

A municipal distribution system could be designed or acquired by San

Francisco with a view to accomplishing one of three general purposes:

First, to cover only a limited and selected group of loads such as the Municipal Railroad System, and such purely municipal usages as street lighting and lighting of public buildings.

Second, a comprehensive system by which the City would serve its entire electrical requirements within the municipal boundary lines;

Third, a combination by which the City could supply a certain portion of its municipal energy to an outside municipality or irrigation district, and utilize the remainder in San Francisco by either the first or the second method.

The first method, namely, supplying the Municipal Railroad and other purely municipal usages, would be inadvisable for the following reasons: It would have to carry as a burden the full charges of the invested generation and transmission capital, which is set in the Engineer's Report at $18,000,000. In addition to this there would be chargeable against it such other capital as would be required for the limited distribution system necessary to carry out the requirements of the load. The greatest disadvantage, however, would be due to the fact that the Municipal Railroad of San Francisco is now receiving energy from private companies at a very low rate, and consequently this major portion of energy would return the City little or nothing in proportion to the investment involved. These facts were very evidently under consideration by the Chief Engineer of the City when he recommended that, if San Francisco go into the business of distributing electrical energy, it build or acquire a complete system capable of serving the entire City of San Francisco.

The second method, if carried out, would show the following investment in production capital according to Chief Engineer O'Shaughnessy's report of April 4, 1923, to the Public Utilities Committee of the Board of Supervisors. In this report he gives the following figures for production and transmission capital invested in the present Moccasin Creek Power Plant:

Power House	$ 7,000,000
Aqueduct	5,000,000
Hetch Hetchy Dam	3,000,000
Transmission Line	3,000,000
Total	$18,000,000

The $8,000,000 apportionment for aqueduct and dam allocated to the electrical features is in accordance with Section 9, Clause M of the Raker Act, and is for the purpose of establishing a value for the electrical energy generated.

In addition to the above investments, the following electrical distribution capital will be required. In Mr. O'Shaughnessy's report of September 11, 1923, to the Board of Supervisors, he gives the following estimated cost for an independent distribution system with a necessary standby steam plant:

Step-down Substation at edge of City and Main Cable through City	$ 3,500,000
Distribution Substations, Conduits, Cables, Services, Meters, Poles and Wire	30,500,000
Steam Standby Station	6,000,000
Street Lighting Equipment	4,500,000
Miscellaneous Equipment and Headquarters	500,000
Total	$45,000,000

In this same report the Chief Engineer states that San Francisco will require 474 million kilowatt hours in 1925 and the plant at Moccasin Creek as now being constructed will supply only 45 per cent of this requirement. The remainder of the energy would therefore have to be made up from standby steam plants or be purchased from some public utility company. It will be seen from the above figures that with $18,000,000 invested in production facilities and $45,000,000 invested in distribution facilities, or a total of $63,000,000, San Francisco would have a plant capable of supplying only 45 per cent of the electrical requirements of the city.

The table of estimated growth of electrical requirements of the San Francisco municipal area as given in Mr. O'Shaughnessy's report of September 11th, and referring to 1928, indicates that San Francisco will use 549 million kilowatt hours. In order to handle this usage from a municipal system it would be necessary to enlarge the present Moccasin Creek Plant and the Early Intake Plant to their ultimate capacities, and build the projected North Mountain Plant. Mr. O'Shaughnessy estimates that it will take an additional $18,000,000 to install these plants to the desired capacity.

Therefore, in the year 1928, to carry out a scheme of municipal distribution that would handle the entire load of San Francisco the investment in electrical facilities would be as follows:

Present investment at Moccasin Creek Plant	$18,000,000
Building of Distribution System in San Francisco	45,000,000
Extension to Moccasin Creek and Early Intake and construction of North Mountain Plant	18,000,000
Total	$81,000,000

Of this amount, $63,000,000 would be required in the form of new capital and would have to be raised by bond issue.

It will thus be seen that it would take an amount of money more than one and one-half times the entire original Hetch Hetchy bond issue to enable San Francisco to enter the distribution field in 1928 and this investment would procure barely sufficient facilities to handle the City's load as it will then exist.

It does not require an engineering analysis to demonstrate that this load would grow rapidly with the growth of San Francisco after 1928 and would then force the city to develop new electrical generating plants, either from new watersheds in the mountains or from steam generating plants in San Francisco. Leaving aside for the moment the question of the normal growth of the City within its present boundaries, it seems highly probable that before many years have passed, San Francisco will extend down the Peninsula, taking territory possibly as far south as Redwood City. Just as soon as any such territory is taken within the corporate limits it becomes immediately eligible for full participation in all municipal utilities, so that the municipal electrical distribution system would under these conditions have to meet an additional load, which in 1928 will probably reach 25,000 kilowatts. With the prospective growth due to heavy industrial development in the Peninsula territory, it is highly probable that this load would increase at a rate much faster than the load within the present municipal boundaries.

In considering the operating features of a municipal Distribution System it must be borne in mind that to meet the rapid growth of electrical load it will require the diversion of all surplus revenue to meet extensions for a considerable period of years. It will be unpractical to finance extensions from bond issues, and therefore the new capital, which Chief Engineer O'Shaughnessy estimates at $2,000,000 per year, will have to be taken from surplus. When it is remembered that this surplus must satisfy all the demands of working capital, insurance reserves, depreciation, etc., it can be seen how impossible it would be to divert any such surplus to the benefit of the water system.

The third method, namely, the possibility of serving outside load as well as the load within San Francisco, cannot receive much consideration, as it has been shown that the Hetch Hetchy System would be inadequate from the start to handle the entire load within the municipal boundaries.

Disposal of Energy Through a Private Utility Company

The private utility companies now handling the electrical distribution systems of San Francisco are quoted in the City Engineer's report as substantially offering the City $2,000,000 for electrical energy from the present Moccasin Creek Power Plant. As the acceptance of this offer would entail no additional investment charges to be carried by the City, the receipt of such a sum annually for electrical energy would offset 80 per cent of the present interest and refunding charges on the entire Hetch Hetchy Development, thereby permitting the City to carry on the construction of the main water system without interruption.

In studying the report of Chief Engineer O'Shaughnessy of September 11, 1923, it is quite apparent that the main reason for building the large power plant at Moccasin Creek was for the purpose of securing revenue to assist in the financing of the water project. According to the Chief Engineer's report, the plan offers "prospects of a revenue from power at an early date sufficient to carry the interest on the cost of the entire mountain development, thus facilitating financing the completion of the aqueduct to San Francisco."

There is, of course, considerable doubt due to the wording of the Raker Act, whether or not San Francisco could directly wholesale its electrical energy to a public utility company. Attorneys disagree widely on the interpretation of the Act, but all agree that no decision will be reached without an adjudication of the case. Solicitor Edwards of the Department of the Interior has expressed the belief that the local power companies could act as the city's agents in distributing the electrical energy from the Hetch Hetchy System; but be that as it may, it is quite apparent that if San Francisco decides that the common sense thing to do is to dispose of this energy through the agency of existing power companies, any legal obstacle existing could be readily removed by taking to Congress a direct application for modification of the Raker Act.

The spirit and intent of the Raker Act was undoubtedly one of conservancy of national sources of electrical energy, and if it could be demonstrated that this conservancy would best be served by temporarily using the present facilities of the power companies, strong showing could be made before Congress in favor of the necessary modification.

Methods of Disposal Compared

Summing up the comparison of the two systems of disposal of electrical energy from Hetch Hetchy, it would seem that the following facts were apparent and point the way to a common sense solution:

First, by building or acquiring a municipal power distribution system at the present time, San Francisco would have to sell bonds to the extent of $63,000,000, which, if legally possible, would seriously prejudice the issuance of $70,000,000 in bonds which are vitally necessary for the completion of the aqueduct and the acquisition of the Spring Valley System.

Second, no revenue from such a municipal system could be diverted to the assistance of the water project, as it would require all available surplus to meet the rapid growth of new business on the electrical system.

Third, even the ultimate Hetch Hetchy hydro-electric development would have reached the limit of its capacity to serve in the year 1928, thus necessitating the city's development of other power sites in the mountains or the building of large steam plants in San Francisco.

Fourth, a wholesale disposal or agency disposal of electrical energy for a sum estimated at $2,000,000 would pay 80 per cent of the interest and refunding charges on the entire present development.

Fifth, the plan of a wholesale disposal of electrical energy would require the investment of no new capital and would permit the concentration of all the City's financial resources for the completion of the water project, at the earliest possible moment.

Sixth, the income from the wholesale disposal of power if applied to payment of interest charges on the whole investment would proportionally benefit other communities joining with San Francisco in the Hetch Hetchy Project. If the power were used entirely in San Francisco, however, difficulties would at once arise as to an equitable sharing of the financial burden.

EFFECT OF CHEAP POWER RATES

The statement is often made that municipal ownership of power generation and distribution will reduce rates and thus contribute to the welfare and growth of the City undertaking it. It is possible that in certain instances electric rates may be lower under municipal than private ownership, especially where interest charges are paid from the general tax levy. The municipal area of a company carrying a general load is the most profitable. Furthermore a municipality is relieved from payment of State taxes and can usually obtain money at a lower rate of interest. It is a question, however, whether lower rates can be long continued in a growing city where large sums are needed for replacements and extensions. Experience has shown that attempts to obtain repeated bond issues for the same purpose will not receive the favorable vote of the people.

The Committee has not attempted to pass upon the question of whether electric energy from the Hetch Hetchy Project can be delivered to the consumer from a municipal distribution system at a cost such that a material reduction can be made in the private utility rates now in effect.

A study has been made, however, of the extent to which electric rates affect the consumer. An analysis of the 1922 kilowatt hour sales of the Pacific Gas and Electric Company in San Francisco, eliminating interdepartment sales, shows that 76 per cent of the total was absorbed by manufacturing, commercial and residential consumers.

Residential Consumer

Considering first the residential consumer, typical families were selected and the relation of cost of electrical power for lighting and similar uses to the annual family budget was determined. Data were obtained from an exhaustive report on Cost of Living recently made to the California State Civil Service Commission by a special committee appointed for the purpose. The following data are for the year 1921 and apply directly to San Francisco:

Family	Per cent for Fuel and Heat	Per cent for Light (Electricity)
Laborer with wife and three children....	4.3	1.1
Clerk with wife and two children...........	3.1	0.8
Executive with wife and three children	3.1	0.7
	—	—
Average...	3.5	0.9

From this table it appears that the budget of the average family would be affected by but a few tenths of one per cent for even heavy reductions in electric rates on the lighting schedules. With regard to fuel and heat, the porportion of families in San Francisco using electricity is very small. The cost of electricity for this purpose is higher than for gas or coal, expensive equipment is required and special house wiring is necessary. The enormous generating capacity which would be required, and the unbalancing effect upon the system load curve are probably reasons of sufficient potency to prevent material reduction of cooking and heating rates even on a municipal system. In any event the cost of electricity is not the only item to be considered by a prospective consumer. The per cent which the cost of fuel and heat bears to the total budget is thus not likely to change for the average family even under municipal ownership of electrical power facilities.

Manufacturing Consumer

Similar studies were made for the manufacturing consumer. A list of forty-one typical San Francisco industries was prepared and a study made to determine the relation of cost of power to the total manufacturing cost of preparing various products. For this purpose, data were drawn from the published abstracts of the 1919 U. S. Census. The following results of the study are typical and show the extreme range of values:

Item	Per cent
Metal and stone products	1.26 to 2.70
Bakery products	1.69
Furniture	1.11
Canned goods	0.92
Food products	0.38 to 0.94
Boots and shoes	0.51
Clothing	0.22

These figures are indicative of the very small extent to which power enters into the cost of the ordinary manufactured product. It is obvious that in any systematic analysis, low power rates alone would operate to a very minor degree as a drawing card to new industries.

Dependability and Continuity of Service

On the part of the public at large there is a general belief that industrial companies, in locating their new plants, lay great stress on the availability of cheap electrical energy. As a matter of fact, however, the actual cost of electrical energy in industry is a very minor factor in an industrial plant when compared to the more vital question as to its availability in volume of supply and the dependability and continuity of its operations.

Taken anywhere within the well-defined areas of comparable utility groups, there is very little attractiveness from the manufacturer's point of view between the highest and the lowest rate for electrical energy when this is weighed in comparison with the far more vital features of labor supply, transportation facilities, market and other major financial and economic features which cover the selection of a plant. This does not mean that the industrial manager is careless or non-interested in securing the lowest possible rate in the given territory, but from long experience he has found that the features of dependability for supply are of far greater importance than any matter of local rates. This is especially true in the Pacific Coast territory where industrial companies, as a rule, are served from hydro-electric sources with long transmission lines, and consequently serious possibilities of interruption of supply, and the manufacturer and his engineers, if they be experienced at all, look more closely into the questions of duplication of transmission lines and the availability of steam power plant standby than they do into the question of rate schedules.

Electricity performs an economic service in electrical industry which on the Pacific Coast has now reached the stage of indispensability, as no other form of prime mover, other than the electrical motor, can meet the extreme demand for flexibility which is absolutely essential to a manufacturing process under modern conditions.

Very few, outside of those experienced in industrial lines, realize the great loss which occurs within an industrial plant by virtue of interruptions in electrical supply, and experienced manufacturers are giving this question of dependability of supply more and more consideration each year as they foot up the results of losses due to interruptions. The interconnected networks of the public utility companies on the Pacific Coast constitute the greatest insurance against interruptions which have yet been devised by any power group in the nation, and consequently, a single power project, even when accompanied by a proportion of steam standby plant could not offer as attractive a guarantee of continuity of service as can be offered by an interconnected network which has in addition to the steam sources, two or more independent hydro-electric trunk lines.

SUMMARY

The Committee, after studying the various phases of the problem of disposal of Hetch Hetchy power, has reached certain conclusions as follows:

1. The City Administration, although clearly advised by the City Engineer, has not adopted a final or workable plan for the disposal of this power.

2. The issue which now confronts the City Administration and the people of San Francisco is not that of municipal as against private distribution of power, since the City's charter definitely provides that the City shall gradually acquire and ultimately own all of its public utilities. This is being done as rapidly as the financial capacity of the City permits.

3. The real issue is whether or not the Hetch Hetchy shall be abandoned as a water supply project with power as a by-product and allowed to become solely a power project.

4. The City by undertaking at this time to go into the power distribution business would have to obligate itself financially to such an extent that indefinite delay would occur in the completion of the water project. The consequences of such a delay are the probable loss of the basic rights acquired under

State authority to divert Tuolumne River water for domestic and municipal purposes for use in the Bay Region. Furthermore, the City would entangle the Hetch Hetchy Project so that it will be difficult for other communities to find an equitable basis for joining with her in securing water. The City, by delay, may also permanently lose the possibility of co-operation of adjacent communities which on account of the seriousness of their own water problem find it necessary to act quickly in acquiring new sources of supply.

5. The Hetch Hetchy water is essential to the future growth of both San Francisco and the whole San Francisco Bay metropolitan area. It is only one of the large sources of water supply which must within this generation be conveyed from distant points to the Bay Region if the present rate of growth in population and industry is to be maintained.

6. The whole Bay Region, including San Francisco, constitutes an economic and social unit, which time is fast bringing into self-consciousness and its manifestation.

7. The citizens of San Francisco have a responsibility both to their own community and to that of the whole Bay Region, of which they are at present the most important integral part, to preserve from dissipation, entanglement or total loss the basic water rights upon which the Hetch Hetchy water supply project depends.

8. Upon the main issue, namely, whether Hetch Hetchy shall be abandoned as a source of water supply for the Bay Region in favor of a power project for San Francisco, there can be but one answer. It should not be done.

RECOMMENDATIONS

With these conclusions as a background, the Committee makes the following recommendations:

1. The City should not undertake the distribution of Hetch Hetchy power until after the main water project has been completed.

2. Pending municipal distribution, temporary disposal of the power should be made through existing agencies and facilities, either wholesale or as temporary agents of the City, as was done in Los Angeles, the revenue being used to meet interest charges on the investment already made.

3. If the City's legal advisers find that, in their opinion, the Raker Act compels direct municipal distribution, the City should again appear before Congress and seek an amendment of the Act making it workable.

4. San Francisco should not decide upon the ultimate vehicle for power distribution until such time as a policy is fully developed with regard to sharing with adjoining communities its water supply and its consequent electrical by-product.

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